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Miyanaga

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(45) **Date of Patent: Dec. 3, 2002**

(54) **DISTAL ENDOSCOPE PART HAVING LIGHT EMITTING SOURCE SUCH AS LIGHT EMITTING DIODES AS ILLUMINATING MEANS**

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(73) Assignee: **Olympus Optical Co., Ltd.** (JP)

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(51) **Int. Cl.**[7] **A61B 1/06**
(52) **U.S. Cl.** **600/179**; 600/170; 600/129; 600/130
(58) **Field of Search** 600/178, 179, 600/180, 175, 170, 129, 130; 348/68

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(57) **ABSTRACT**

A substrate having a plurality of light emitting diodes united therewith lies on a plane containing the longitudinal axis of an insertion unit of an endoscope. Likewise, part of a first objective surface lies on the plane containing the longitudinal axis of the insertion unit of the endoscope. As long as the diameter of the insertion unit remains unchanged, the plane containing the longitudinal axis of the insertion unit of the endoscope provides the largest area for the light emitting diodes. The light emitting diode sub-assembly is therefore placed on this plane, so that the outer diameter of a distal endoscope part can be made as small as possible.

10 Claims, 15 Drawing Sheets

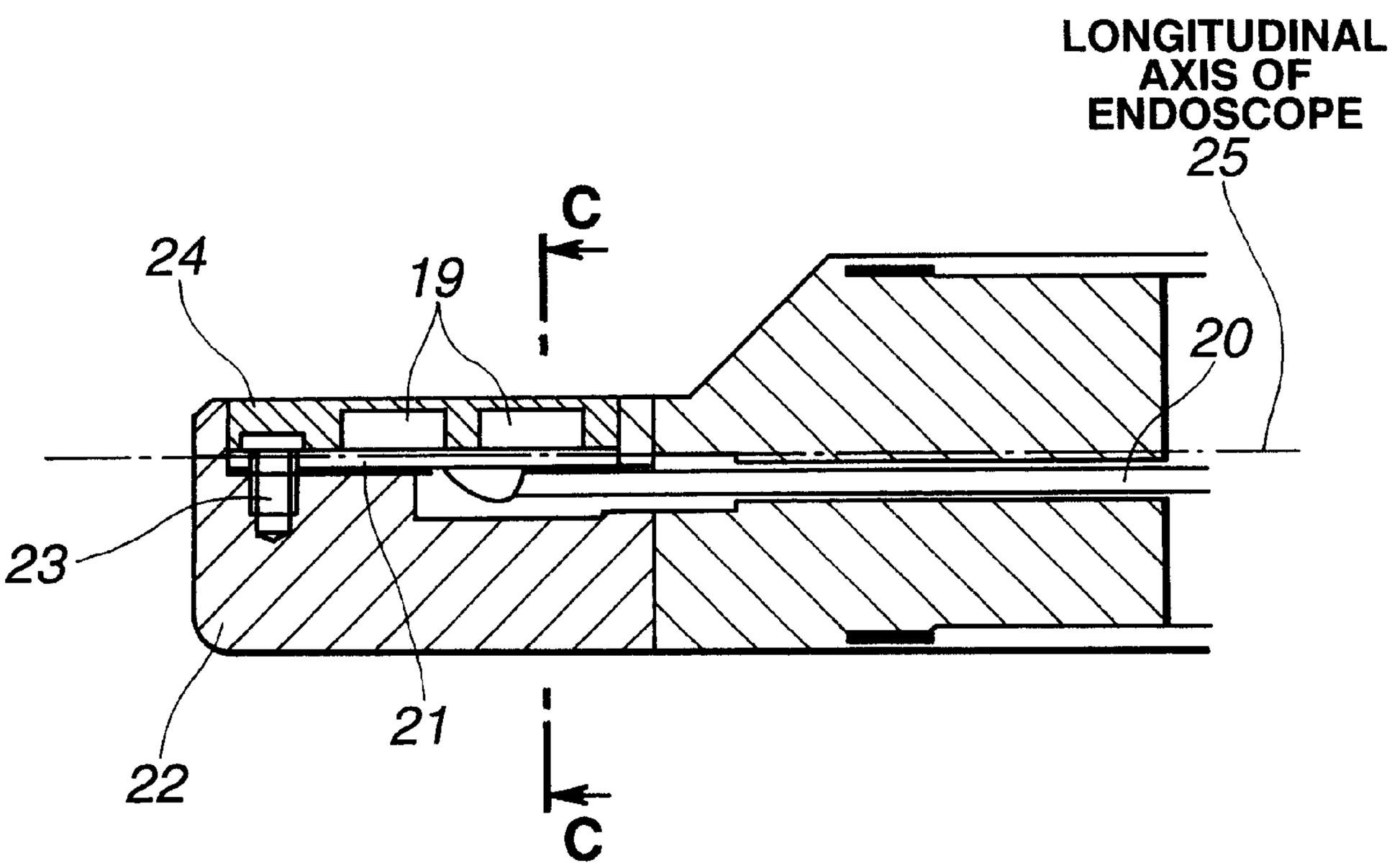


FIG.1

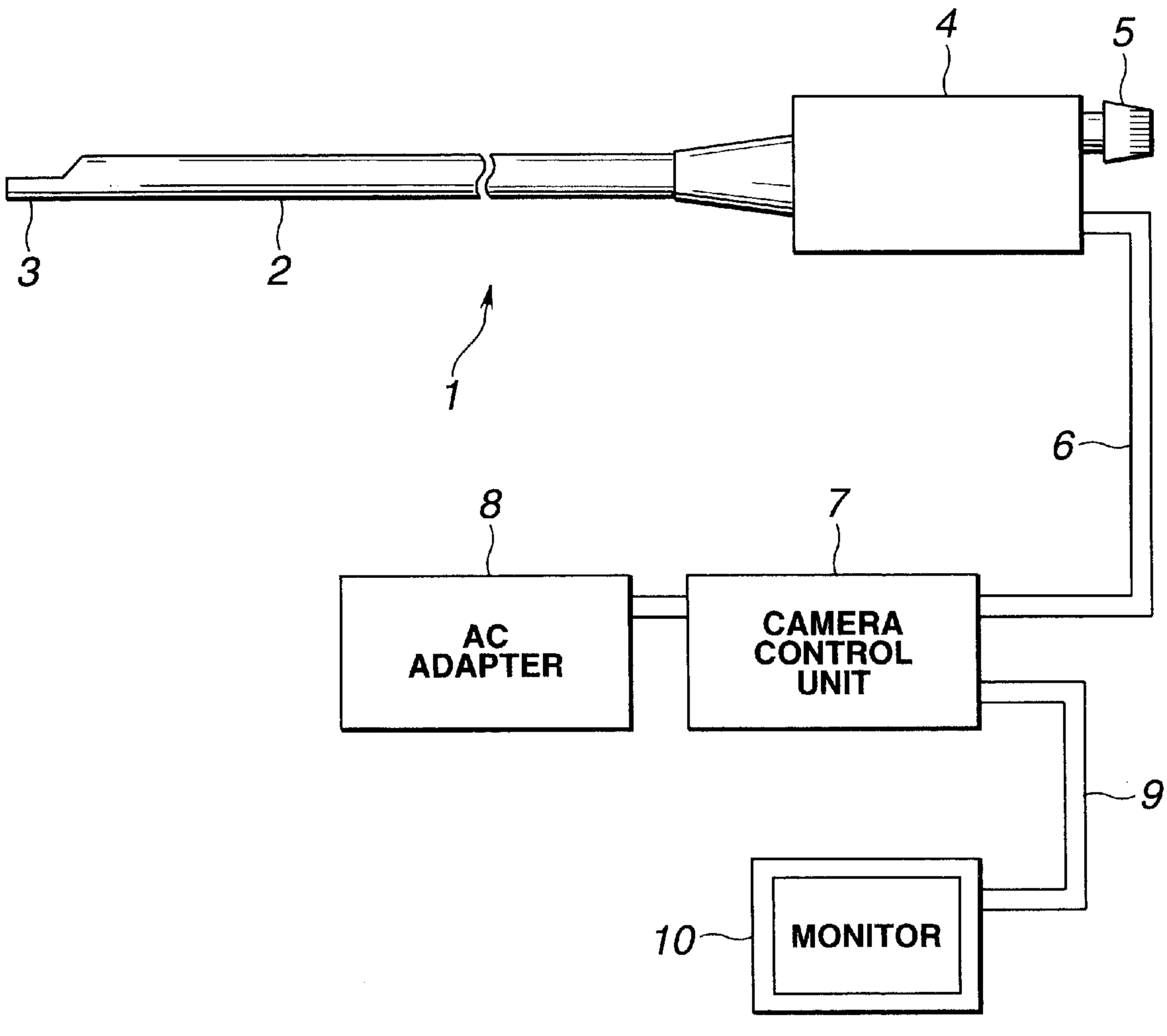


FIG.2

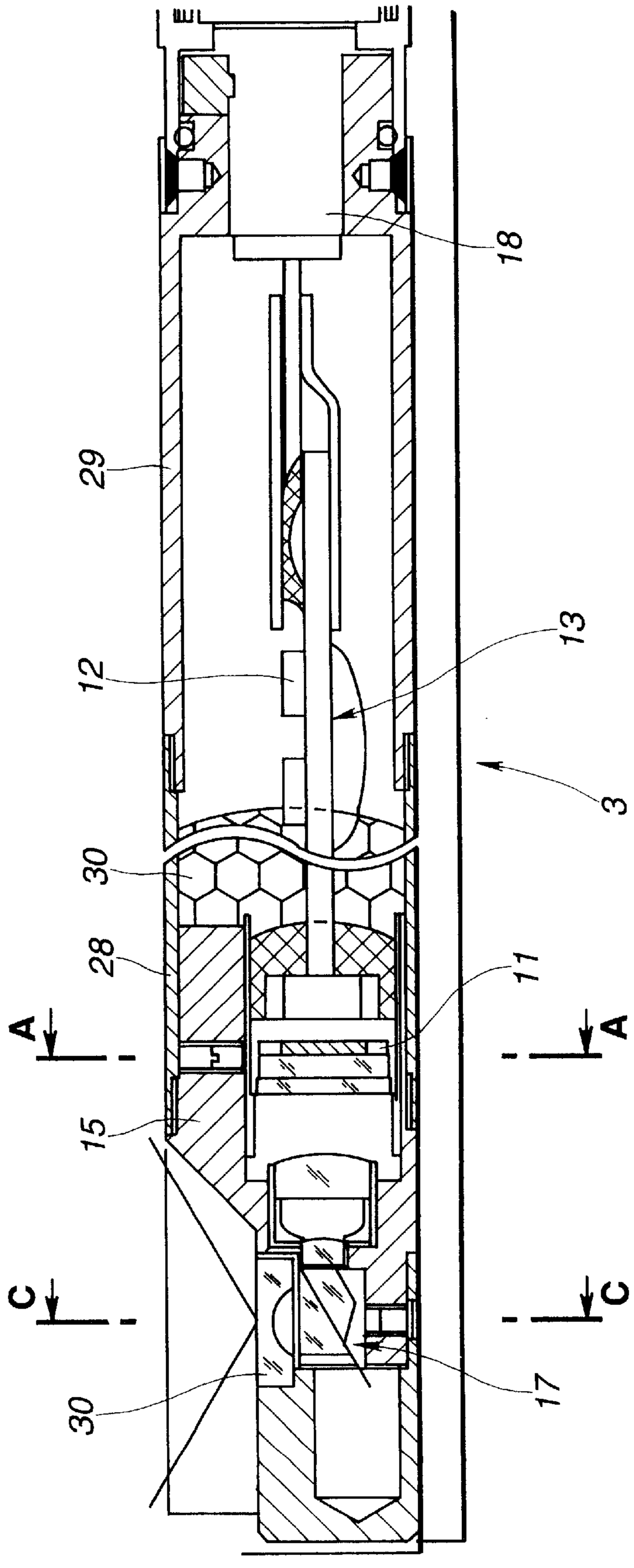


FIG.3

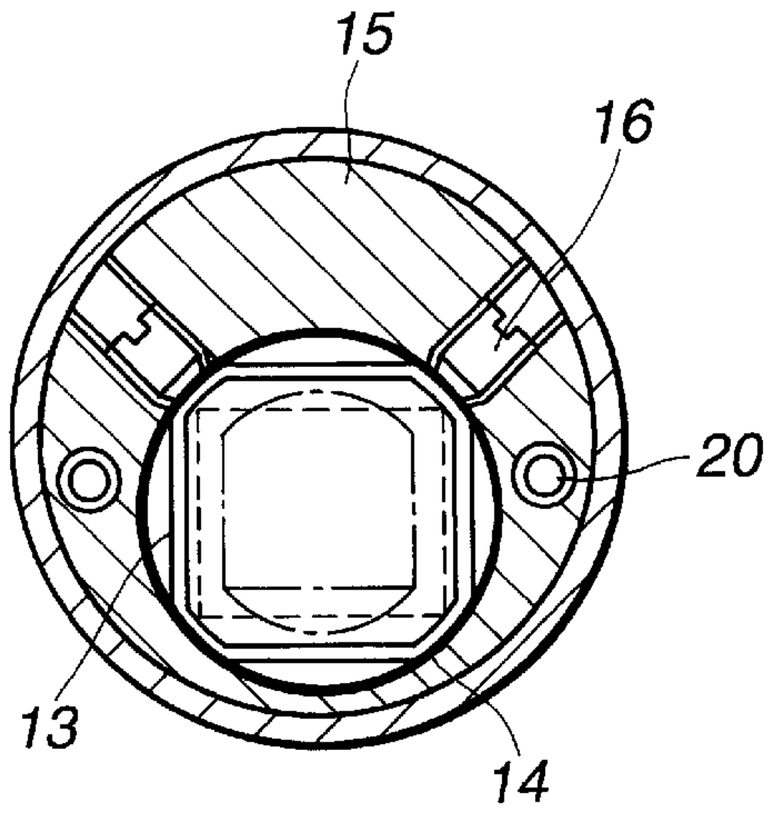


FIG.4

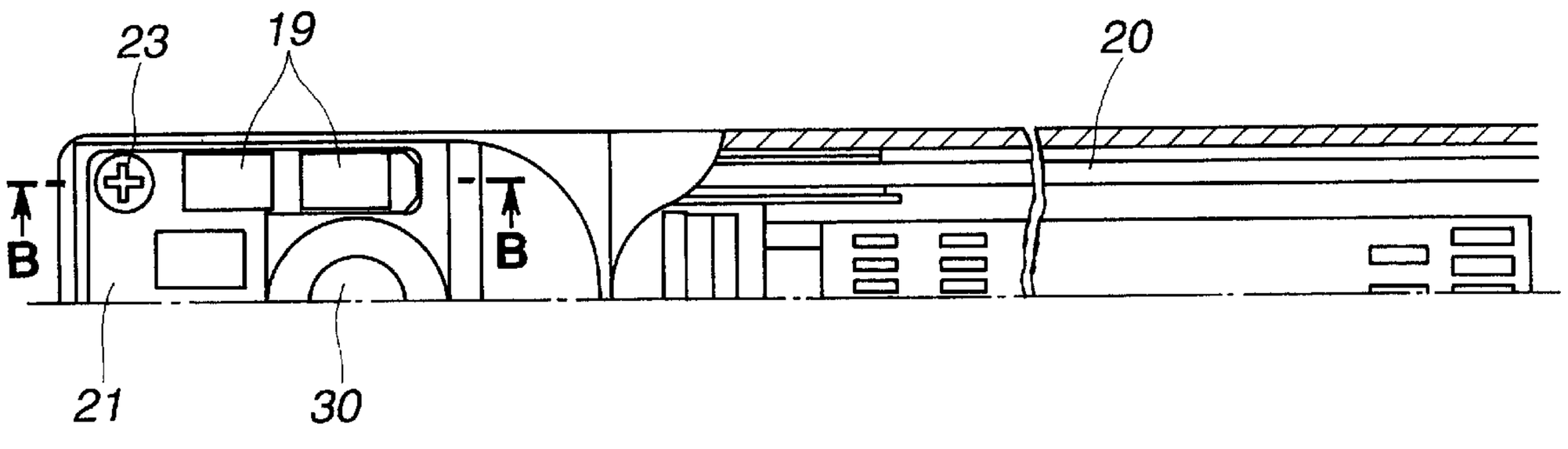


FIG.5

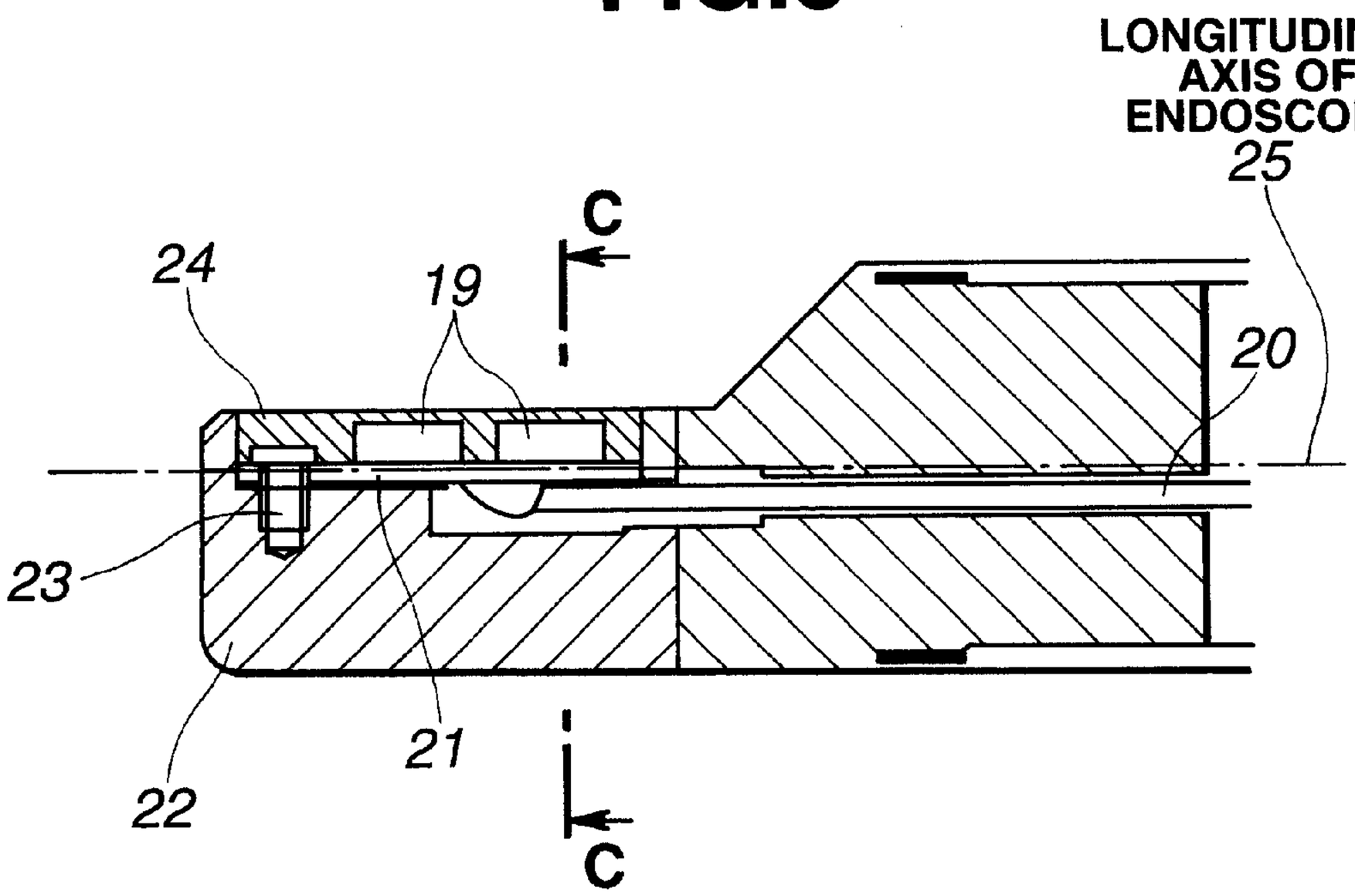

LONGITUDINAL AXIS OF ENDOSCOPE
25
C
24
19
20
23
21
22
C

FIG.6

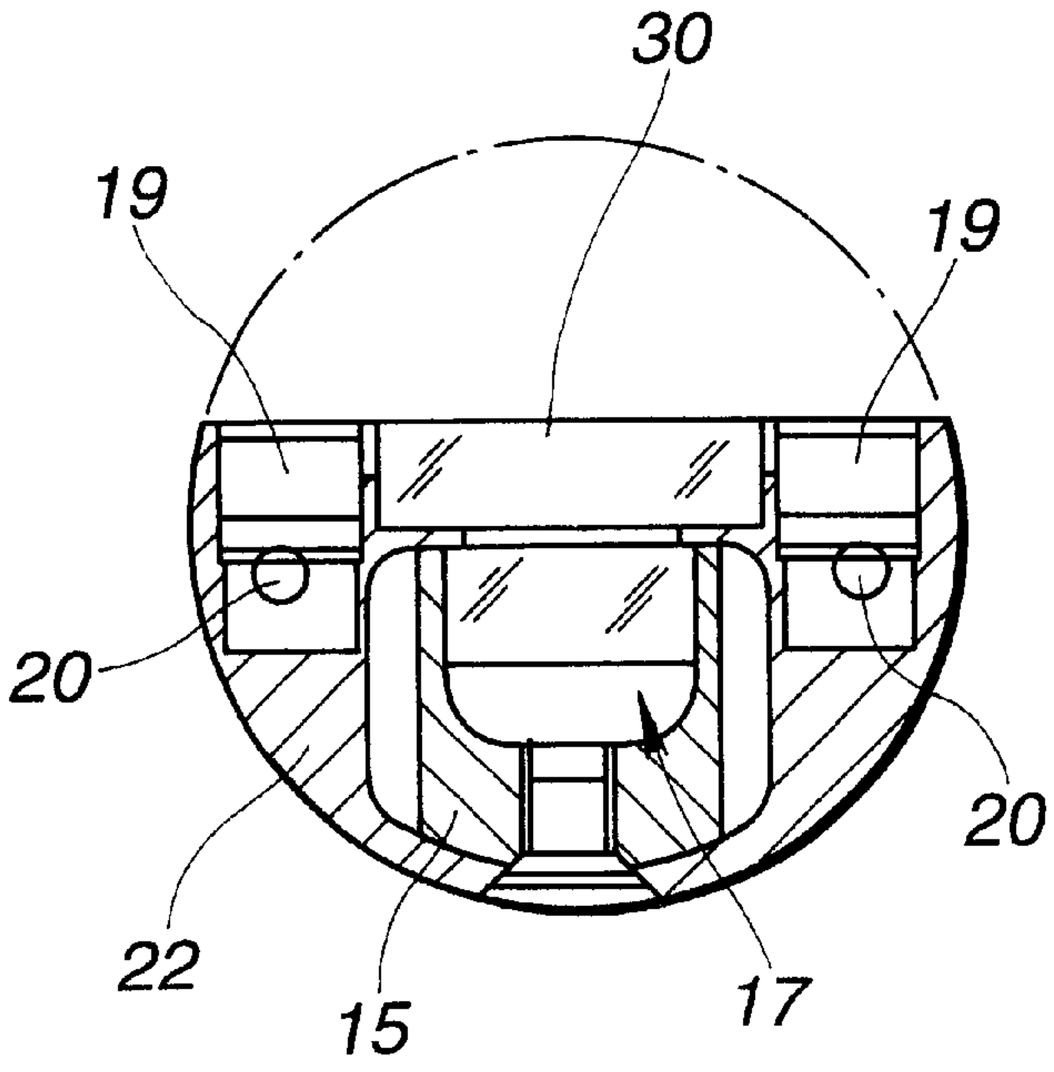

30
19
19
20
20
22
15
17

FIG.7

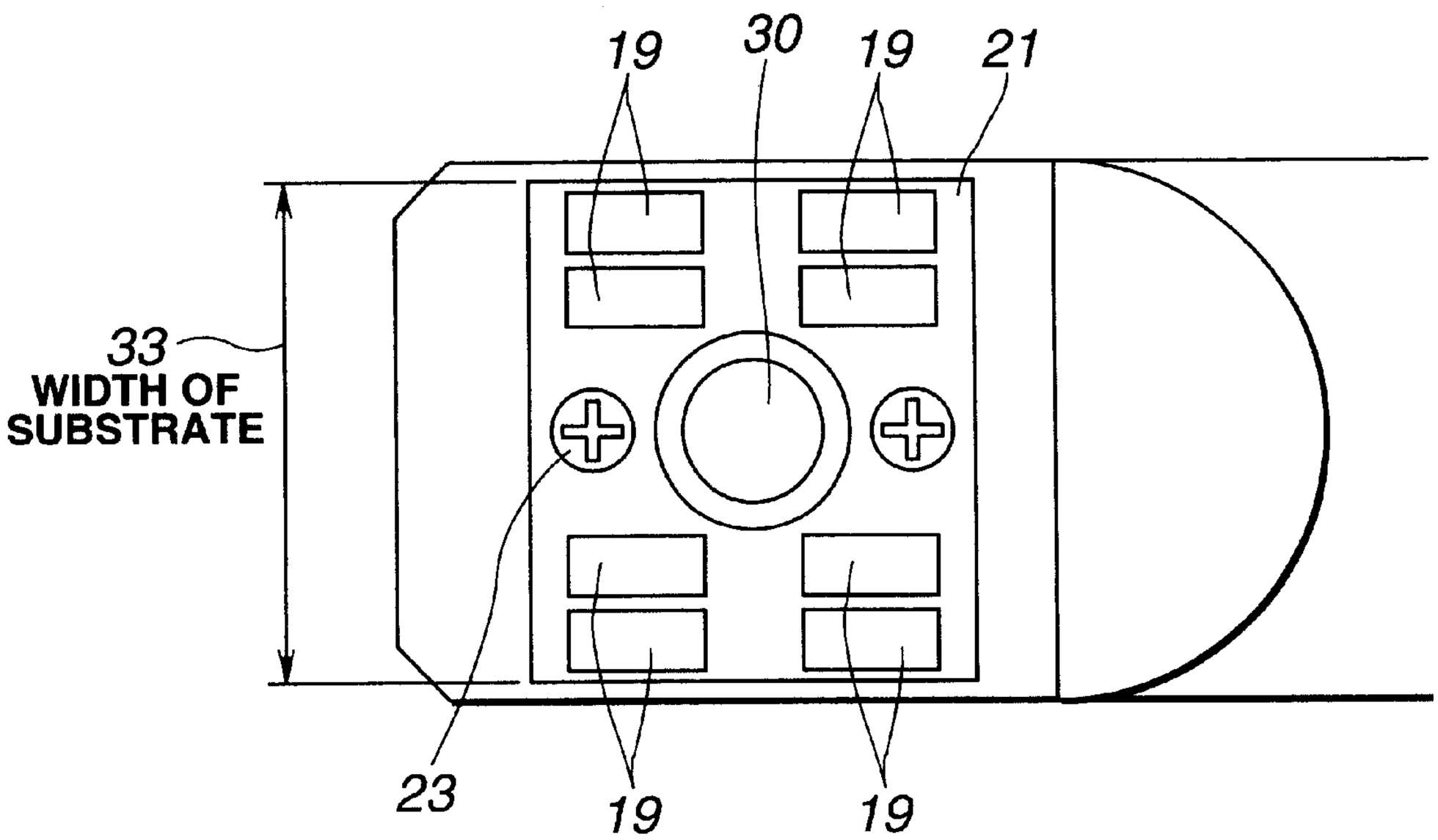

19
30
19
21
33
WIDTH OF SUBSTRATE
23
19
19

FIG.8

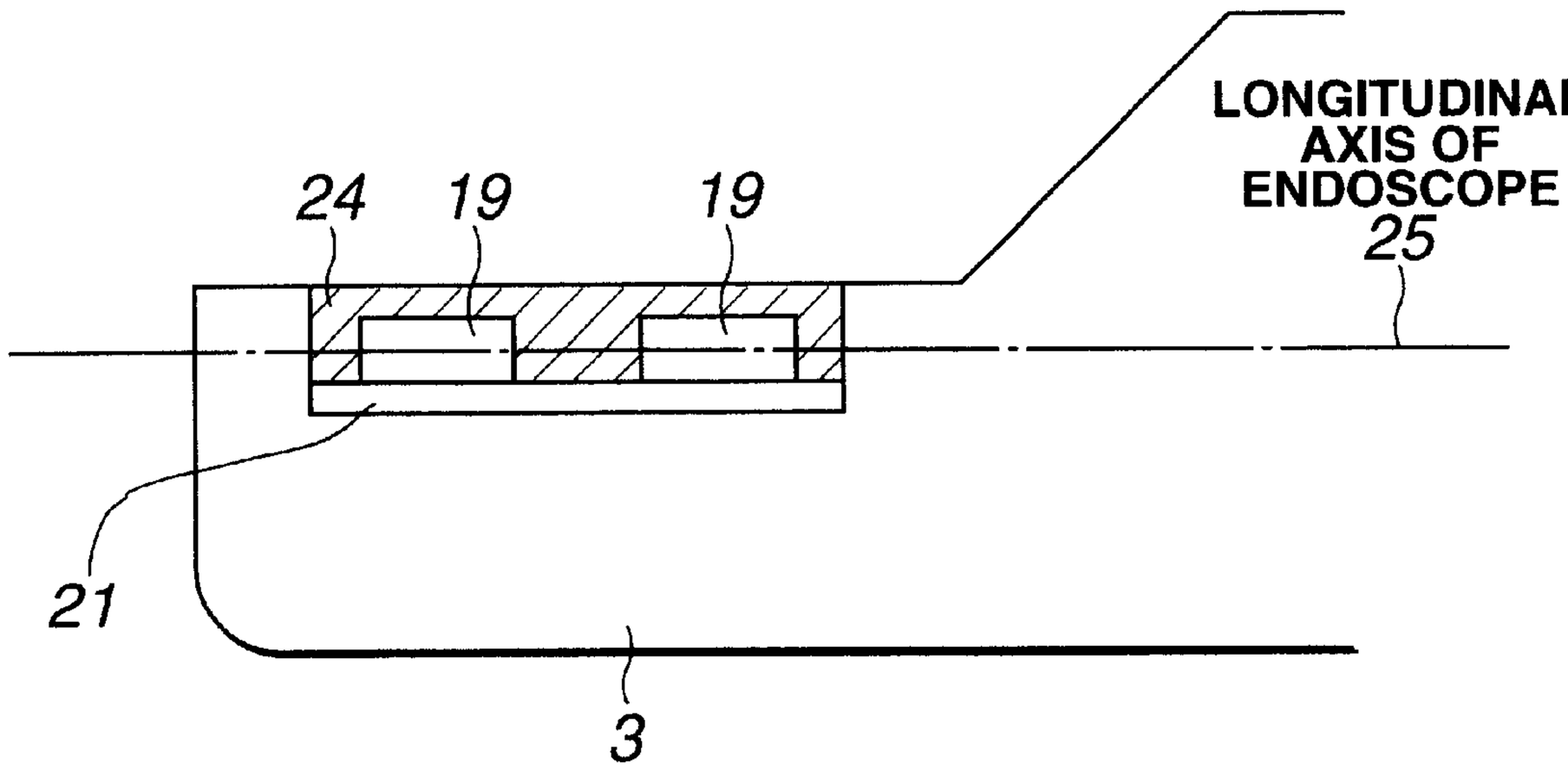

LONGITUDINAL AXIS OF ENDOSCOPE
25
24
19
19
21
3

FIG.9

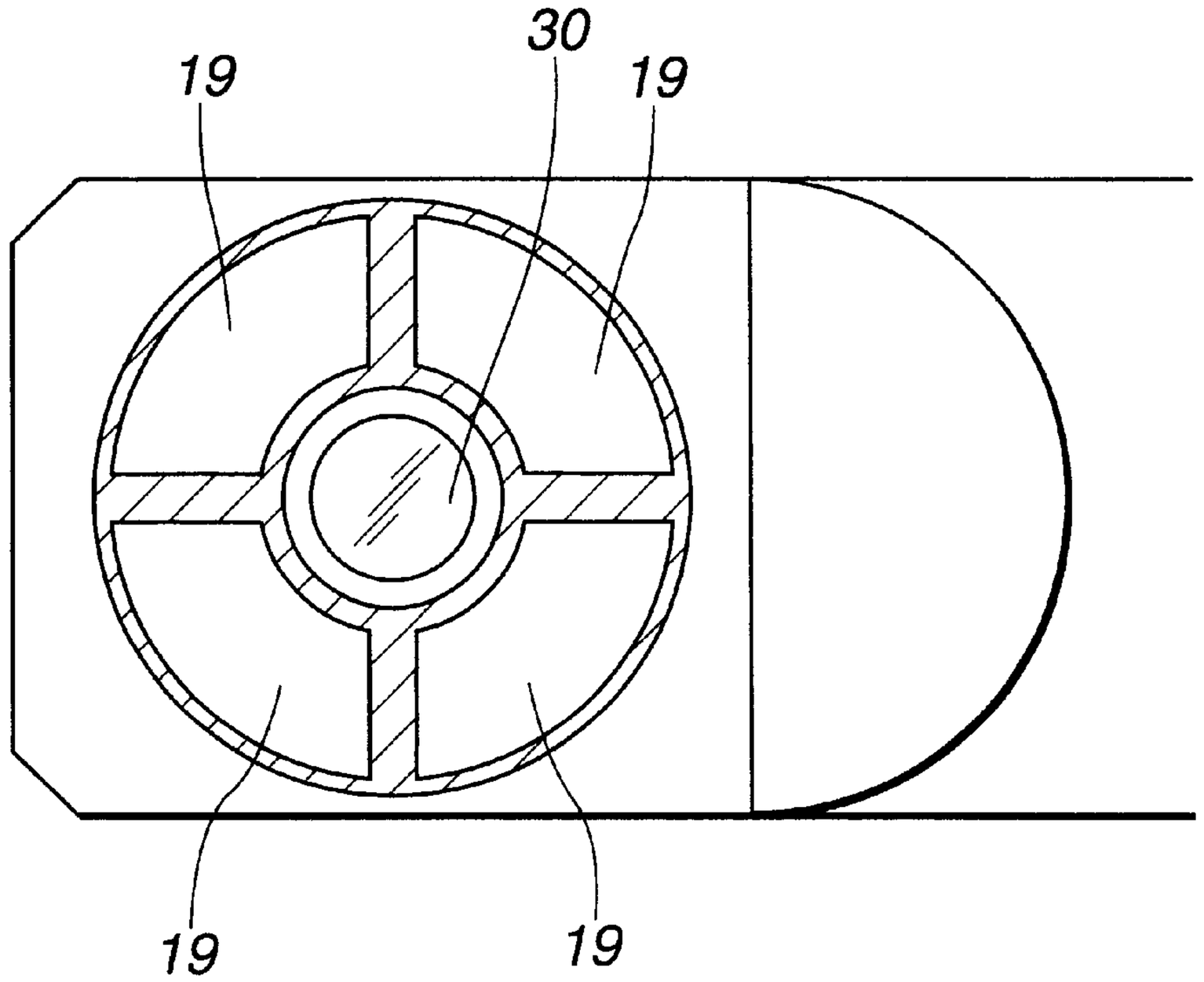


FIG.10

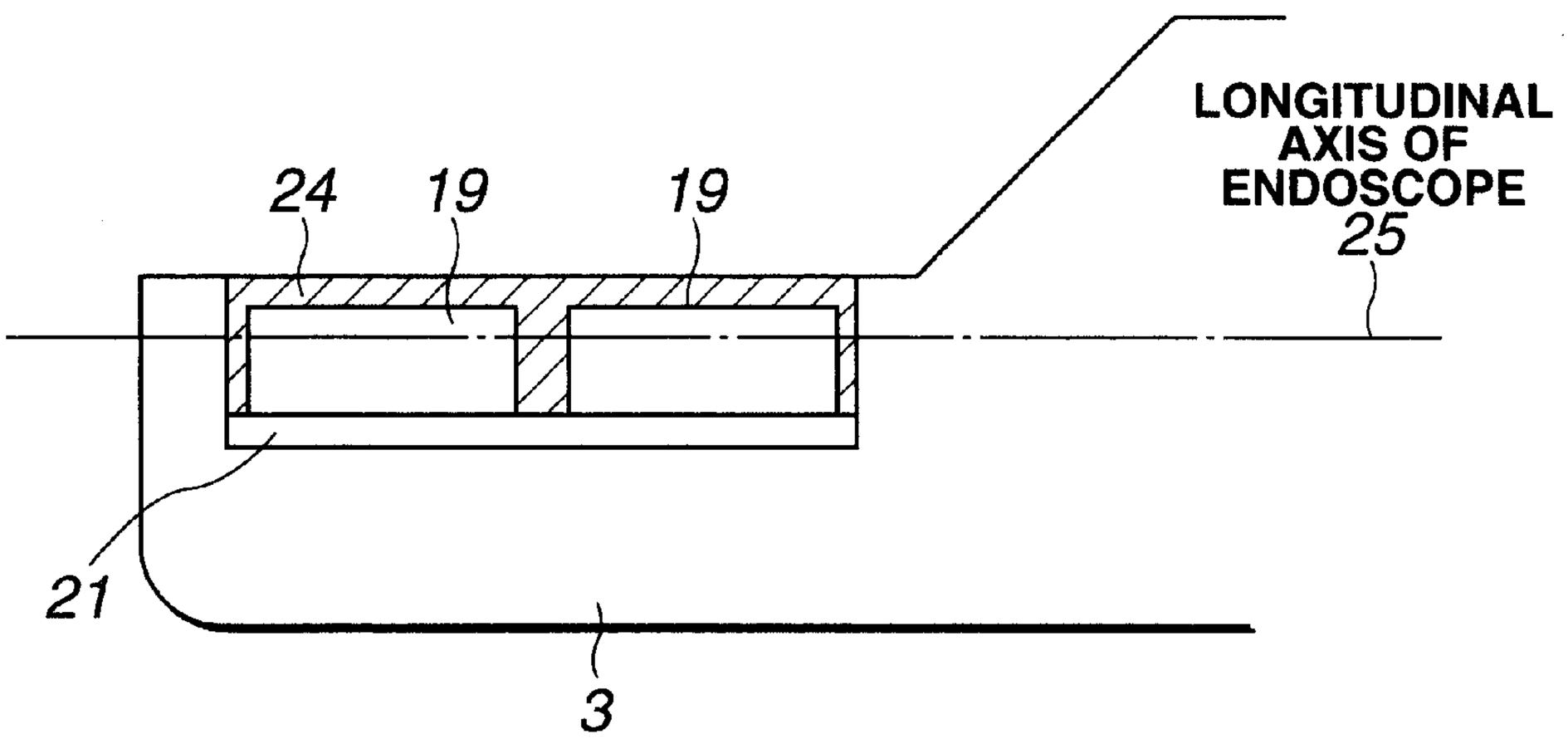
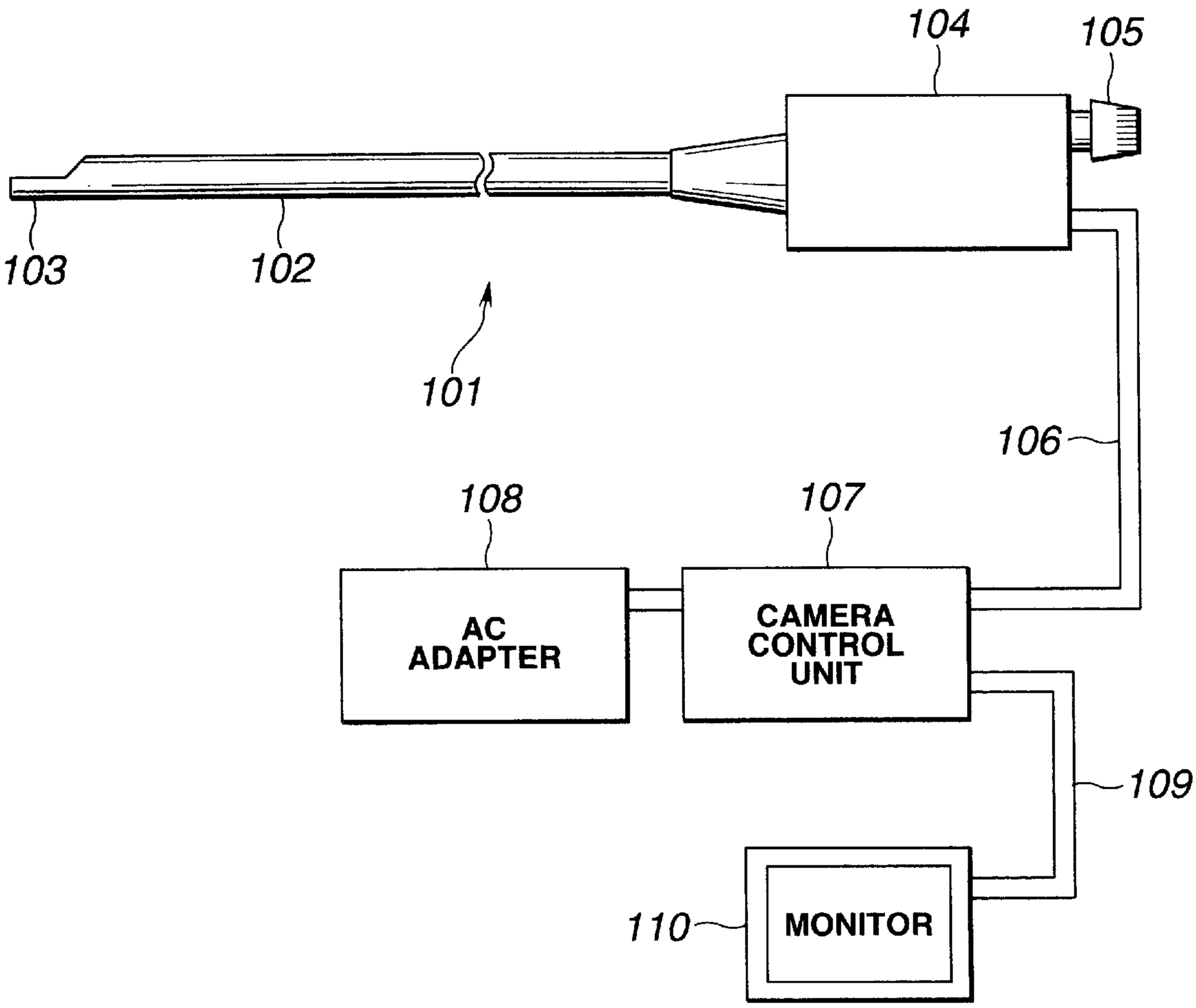


FIG.11


104
105
103
102
101
106
108
107
AC ADAPTER
CAMERA CONTROL UNIT
109
110
MONITOR

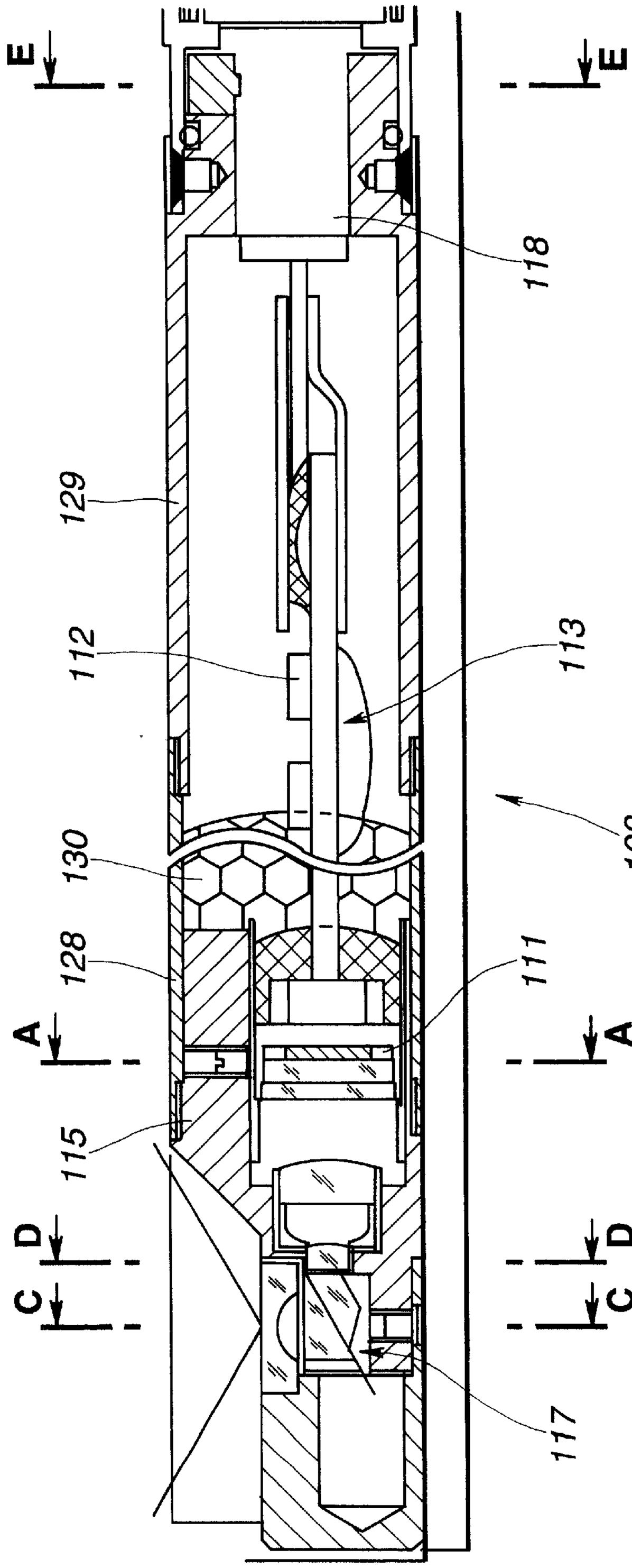


FIG.12

FIG.13

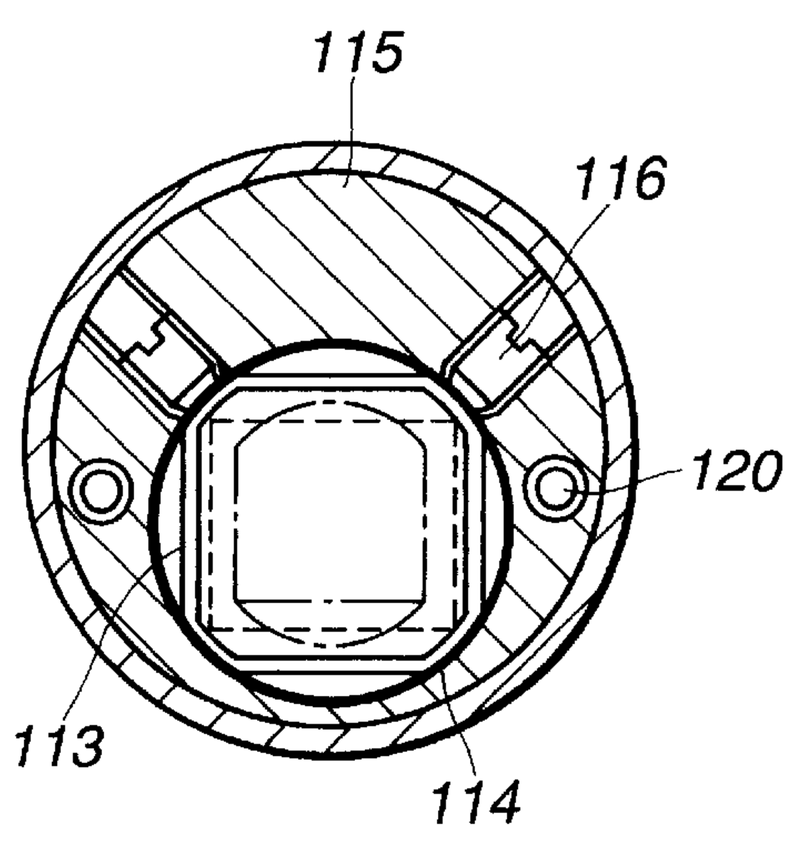


FIG.14

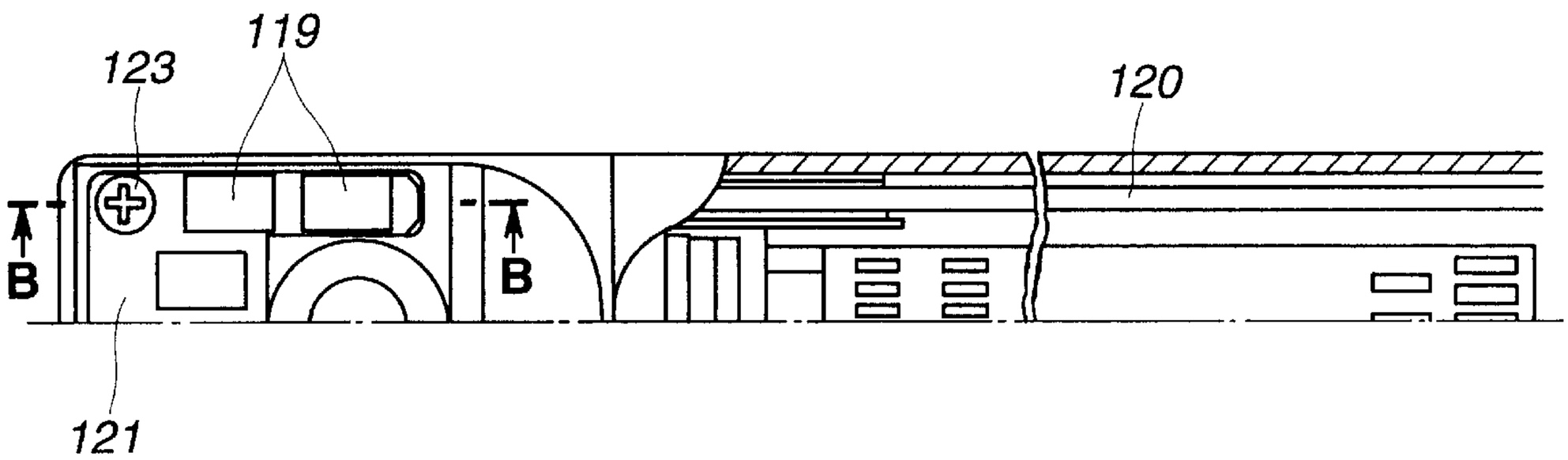


FIG.15

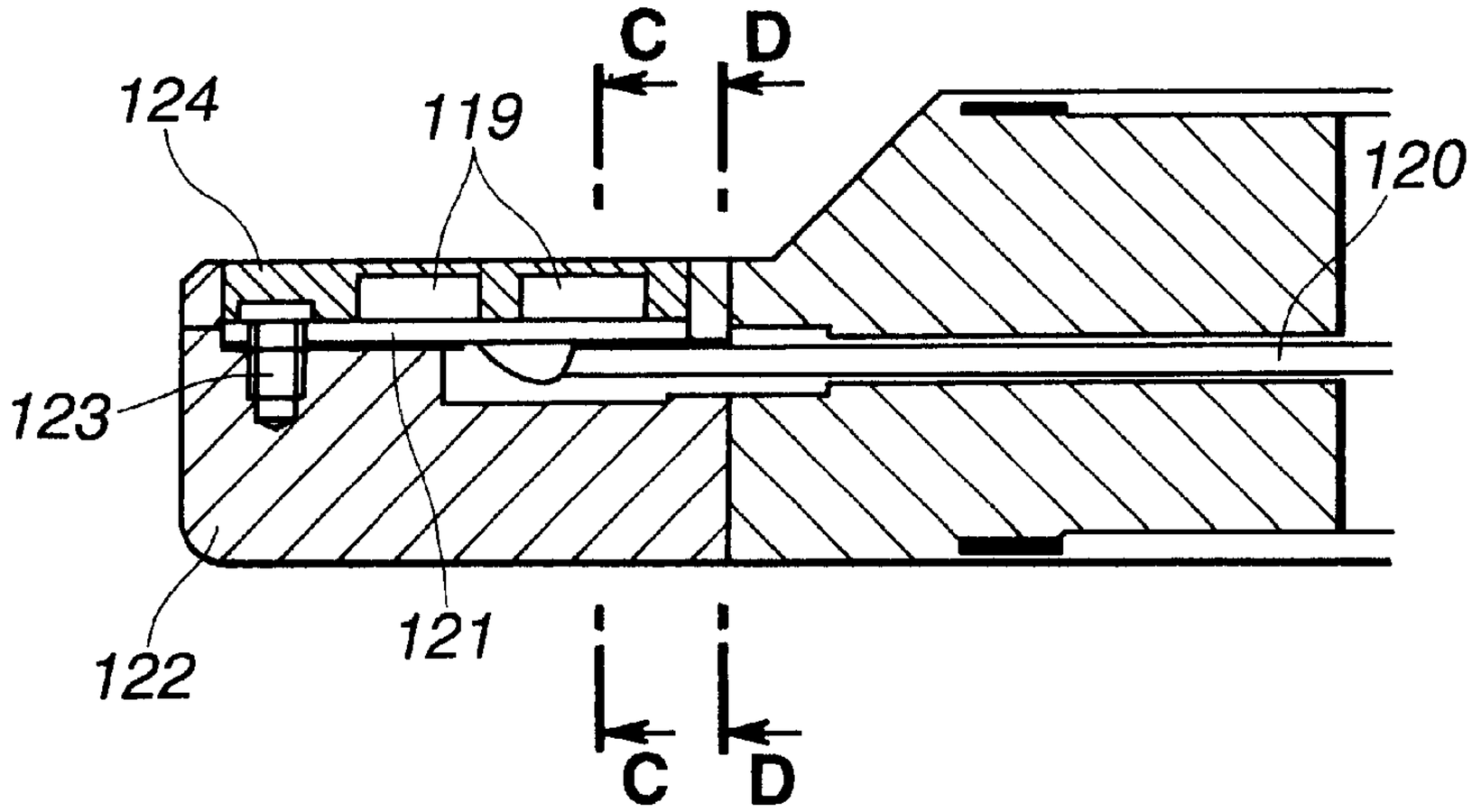


FIG.16

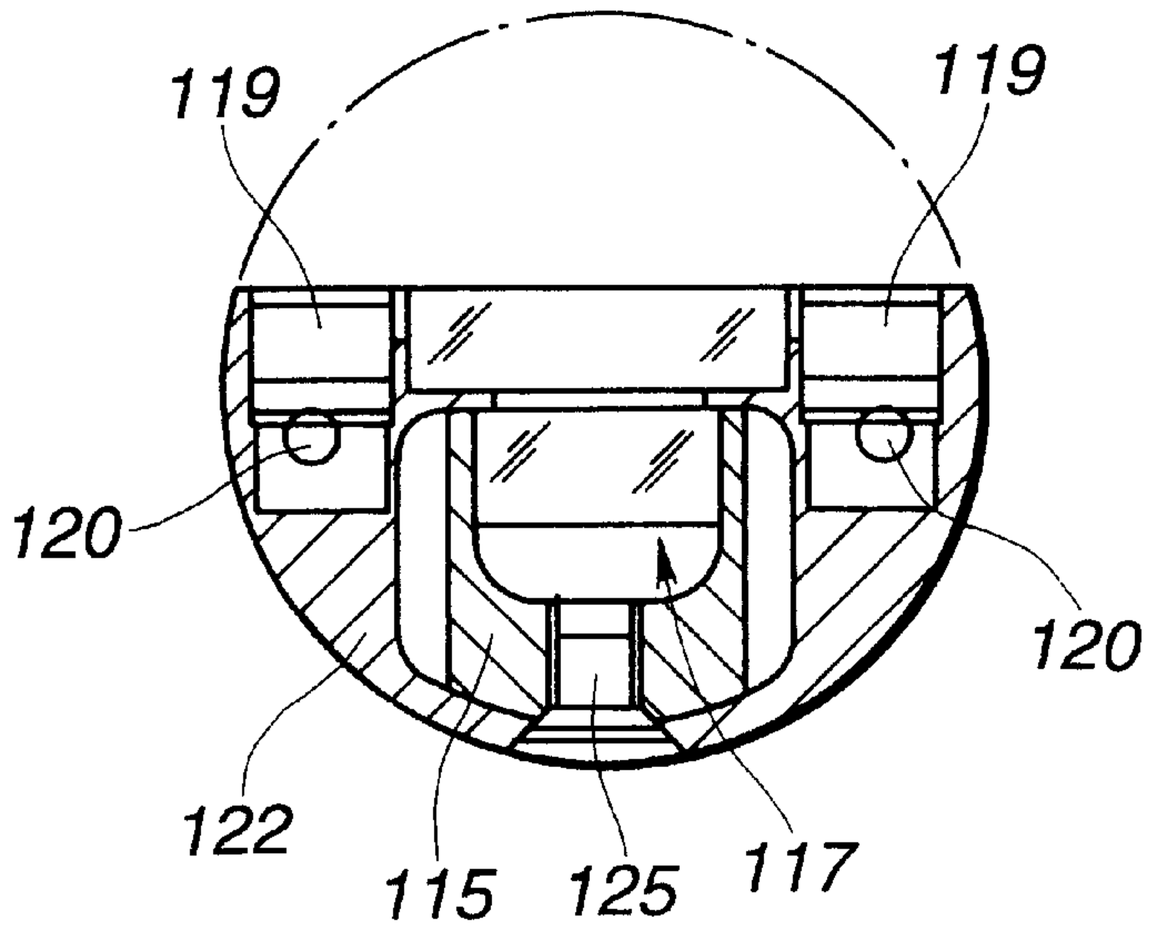


FIG.17

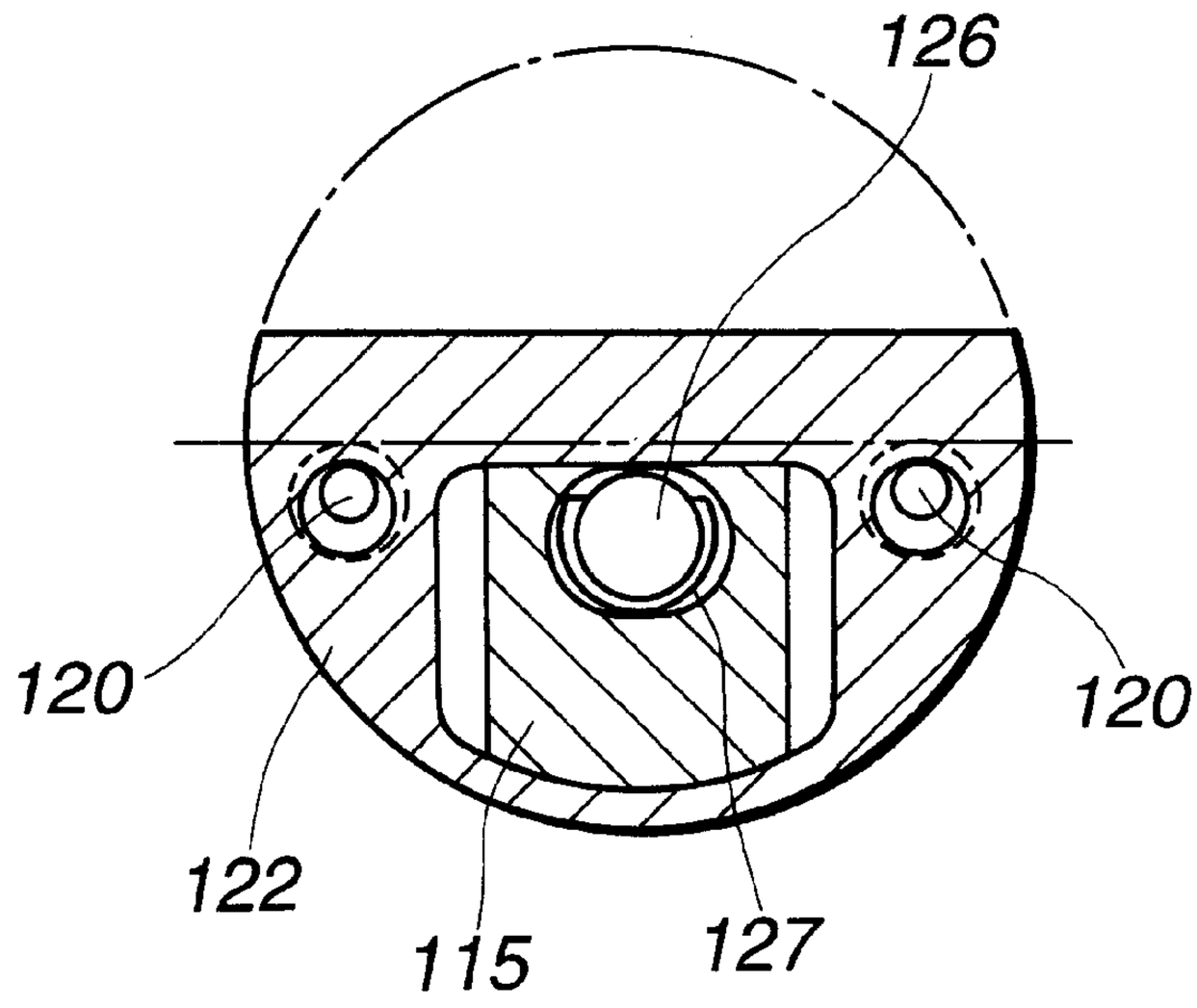
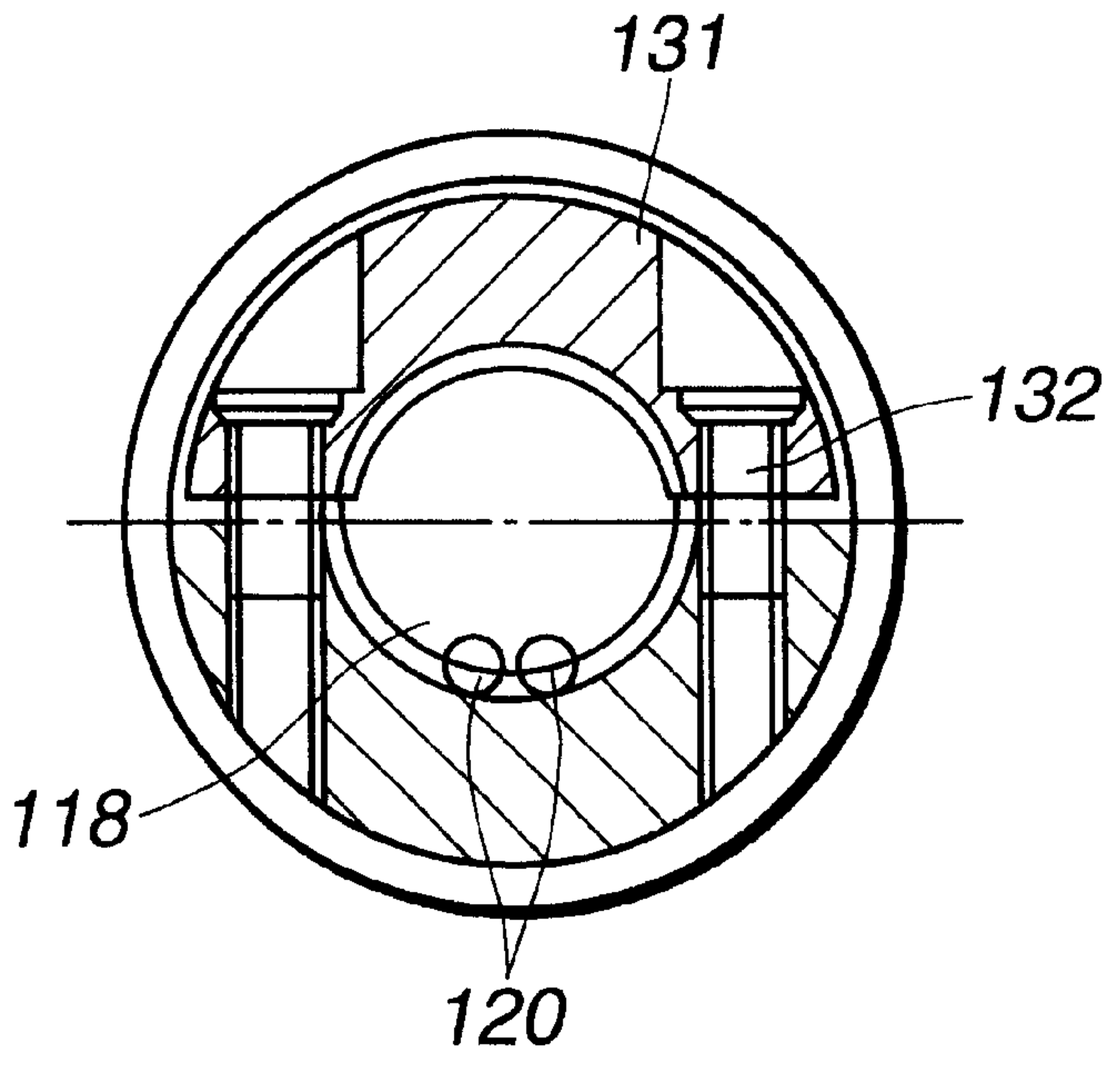


FIG.18



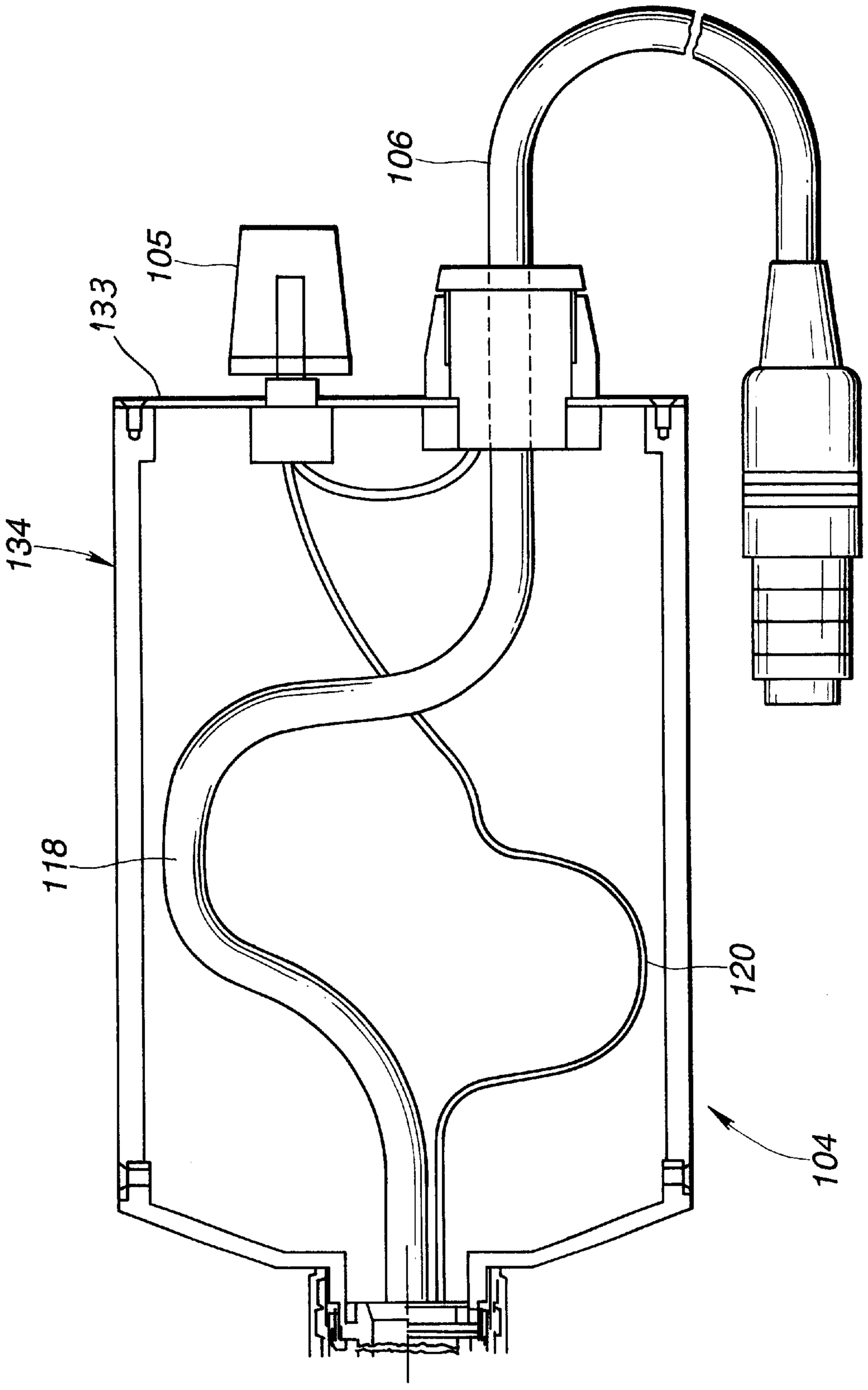


FIG.19

FIG.20

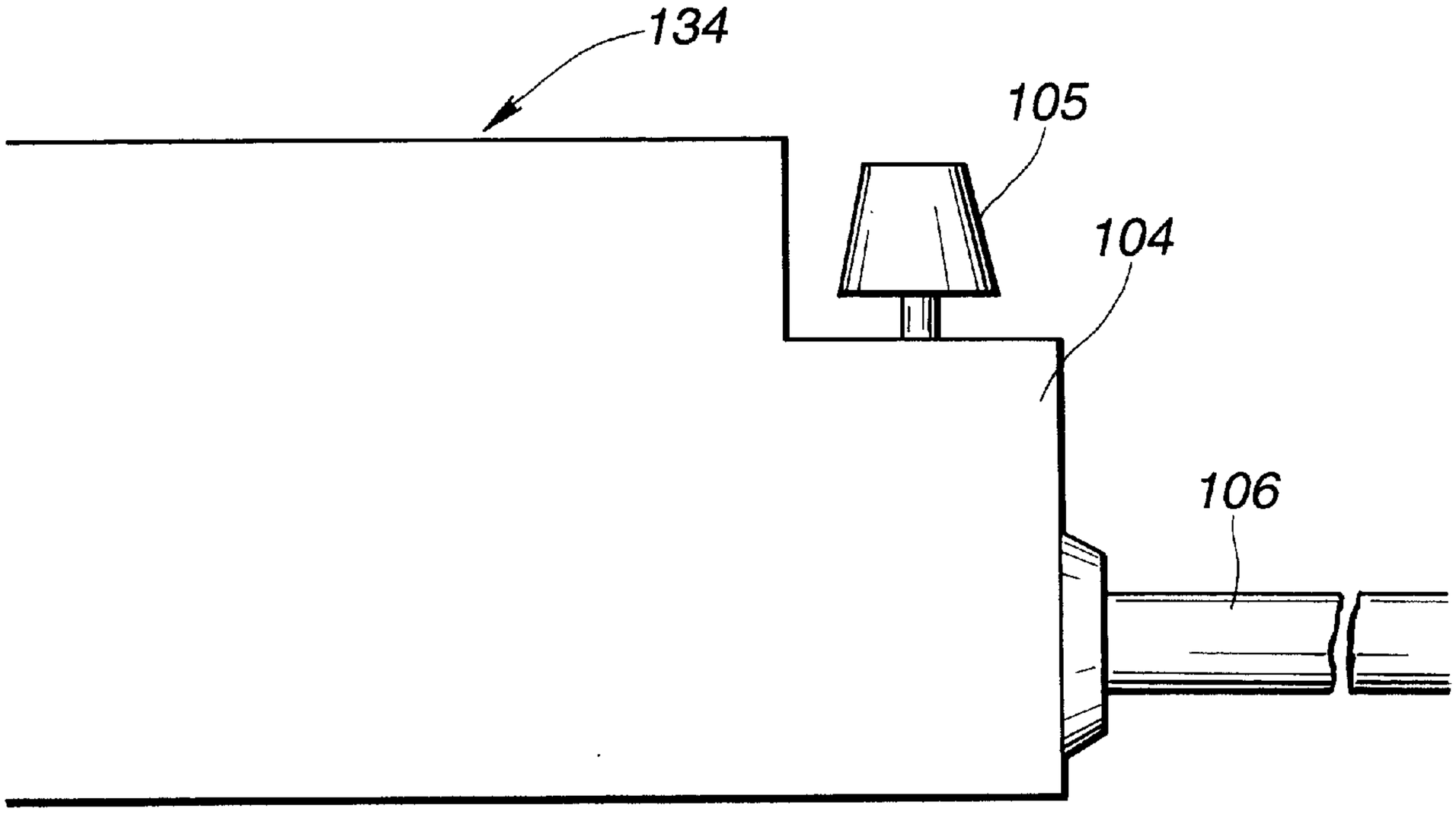
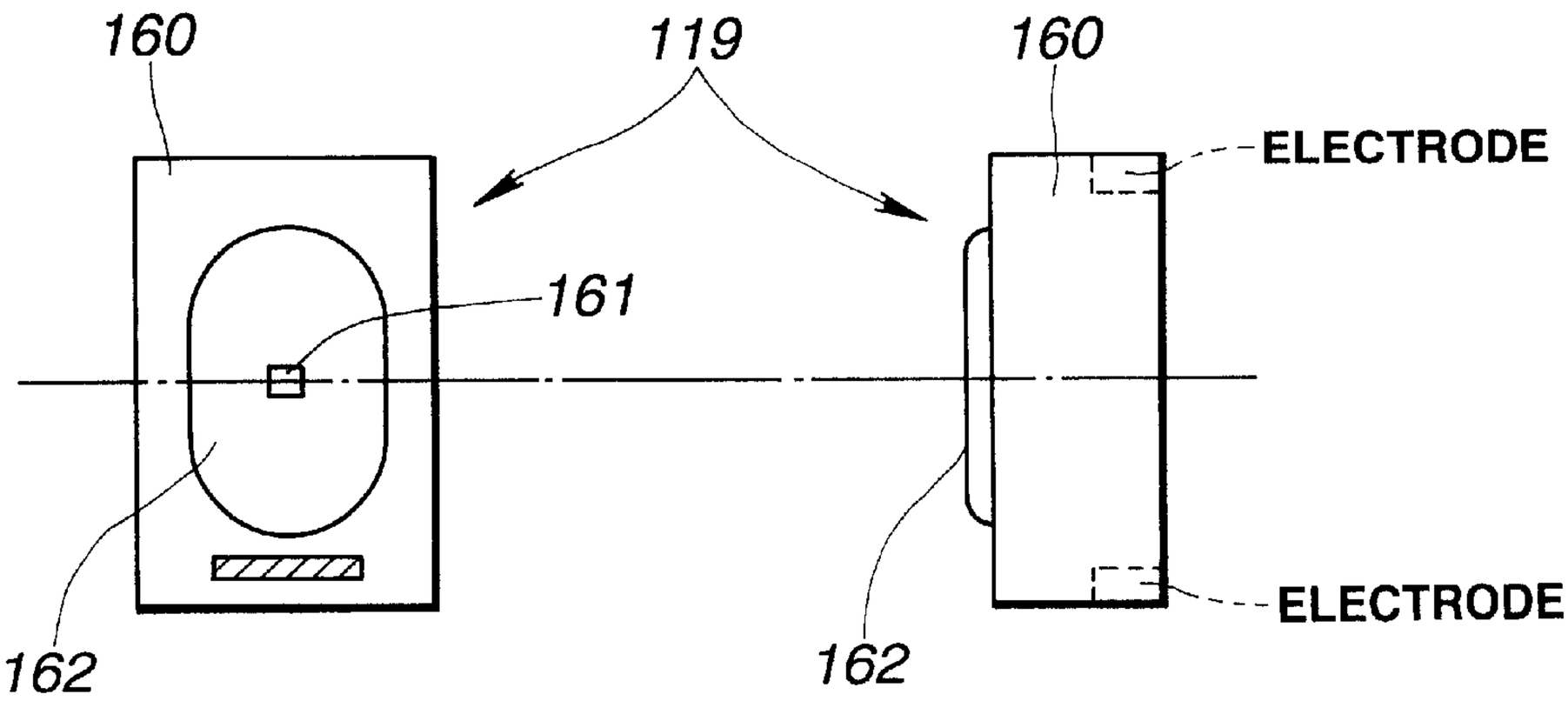


FIG.21



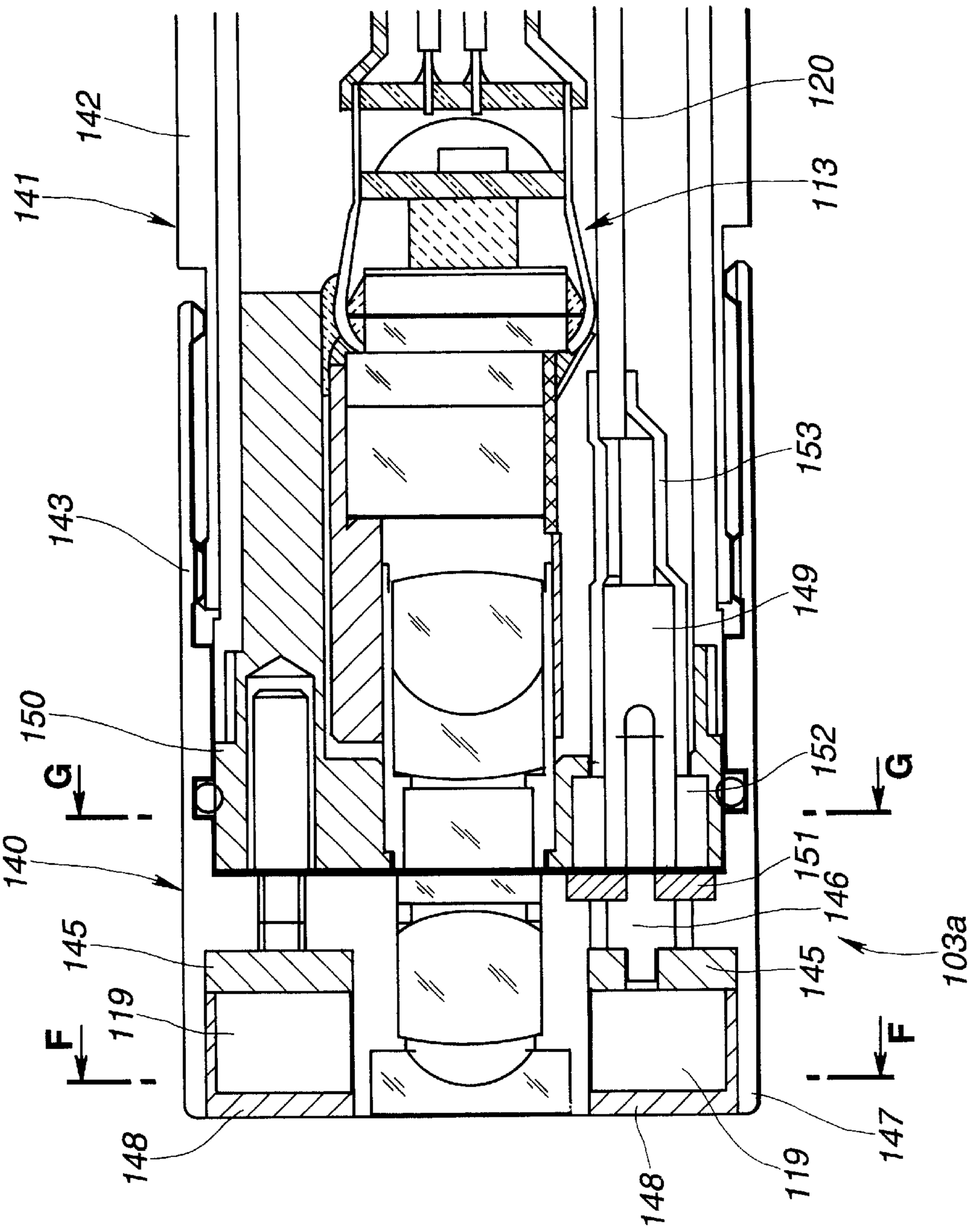

142
141
143
150
G
140
145
119
F
148
120
113
153
149
152
G
151
146
145
103a
F
147
148
119

FIG.22

FIG.23

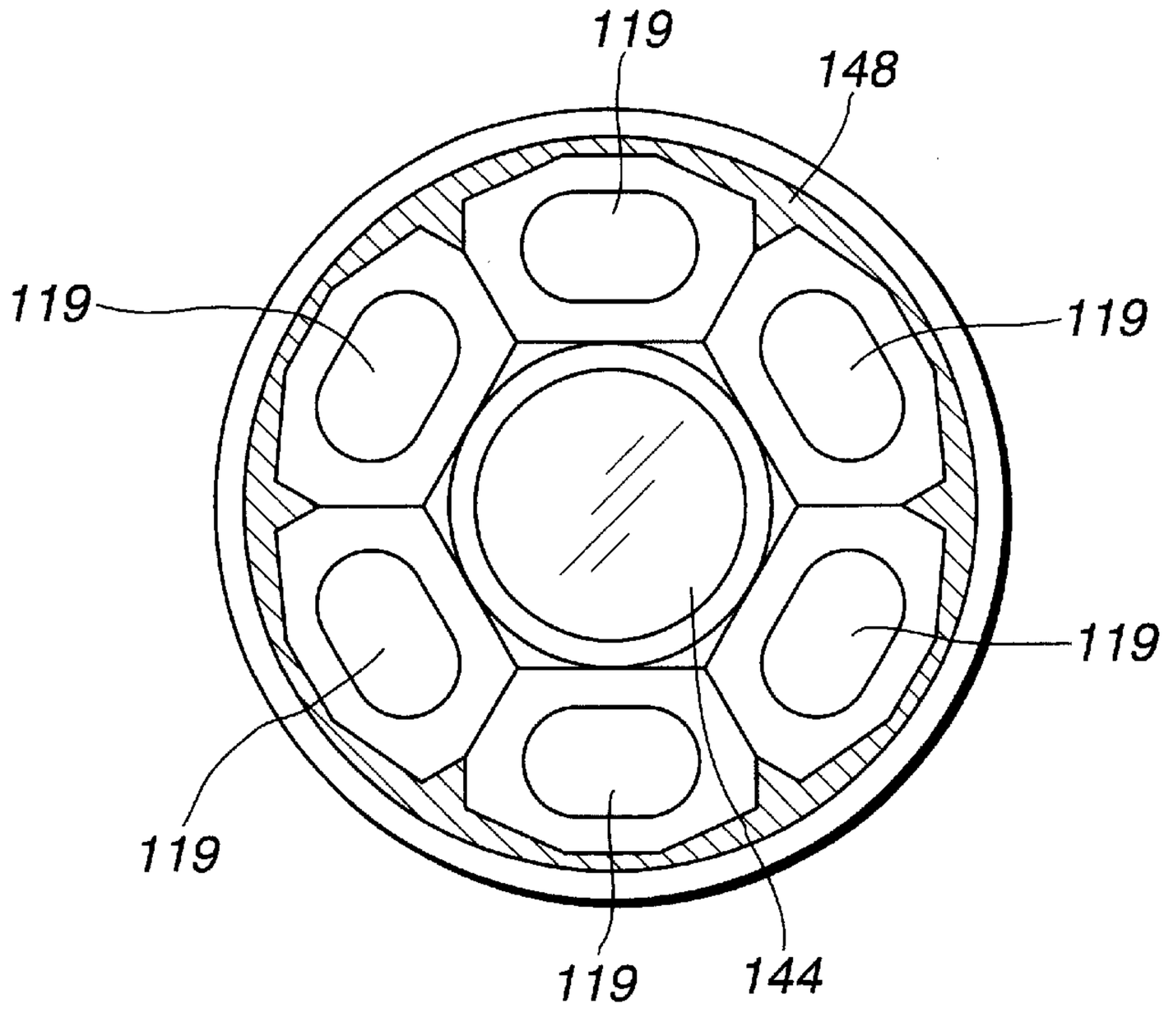
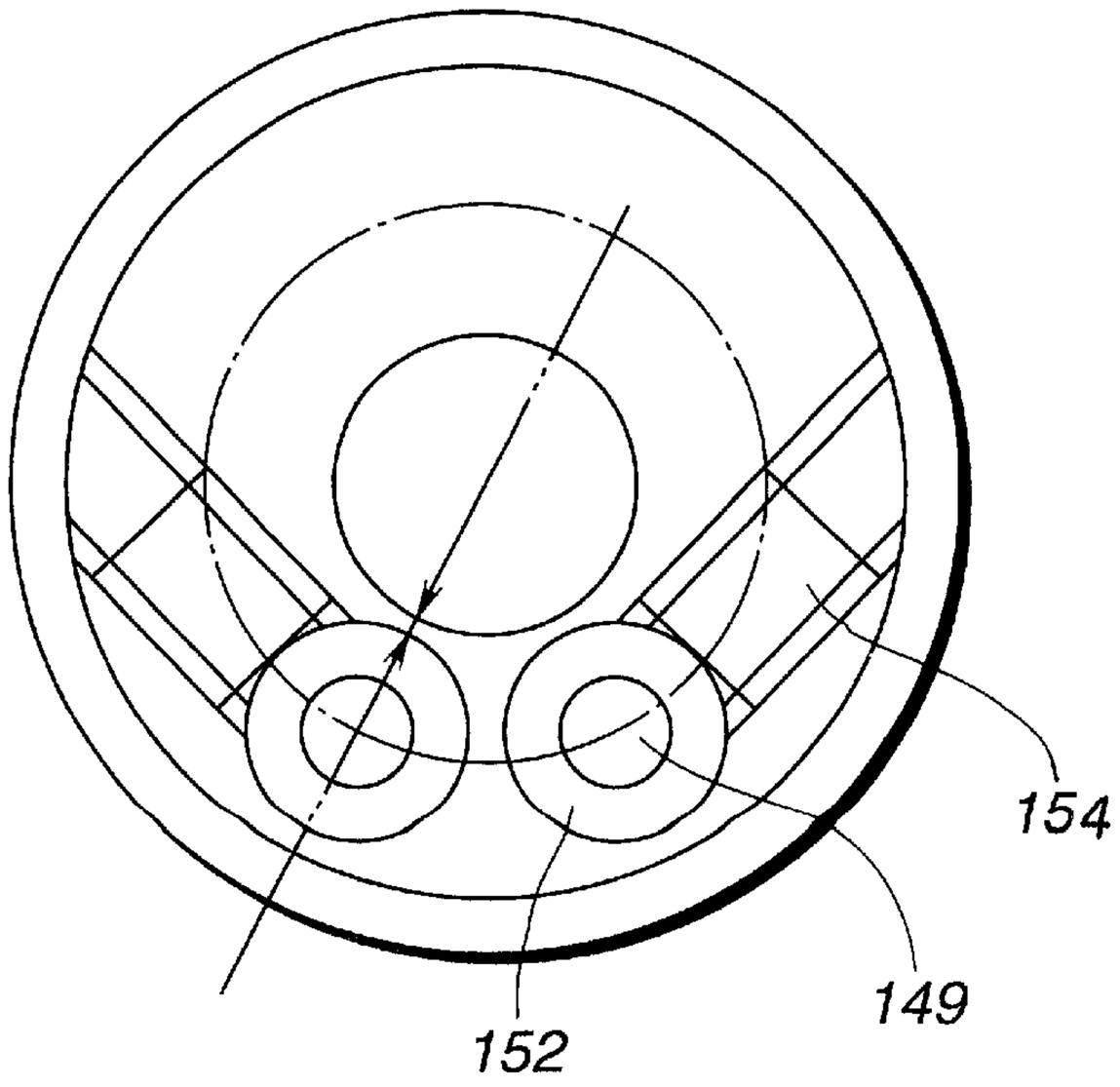


FIG.24



DISTAL ENDOSCOPE PART HAVING LIGHT EMITTING SOURCE SUCH AS LIGHT EMITTING DIODES AS ILLUMINATING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a distal endoscope part, or more particularly, a distal endoscope part characterized by a portion thereof in which light emitting diodes serving as an illuminating means are placed.

2. Description of the Related Art

Structures having a light emitting source such as light emitting diodes incorporated as an illuminating means in a distal endoscope part have been proposed in the past.

For example, Japanese Unexamined Patent Publication No. 63-260526 describes a distal endoscope part for side viewing in which a plurality of light emitting diodes is placed circumferentially with an objective optical system as a center in order to improve the light emitting characteristic of the distal part.

However, according to the prior art (Japanese Unexamined Patent Publication No. 63-260526), the light emitting diodes are placed on a spherical surface on the outer circumference of an endoscope. The plurality of light emitting diodes must be attached one by one to a distal member.

When the light emitting diodes must be attached one by one to the distal endoscope member, there is difficulty in narrowing the spacing between adjoining light emitting diodes. Therefore, a side viewing endoscope having a plurality of light emitting diodes placed on the outer circumference of an objective optical system has a drawback in that the distal part thereof is large in size.

Japanese Unexamined Patent Publication No. 8-117184 proposes a structure having a light emitting source as an illuminating means incorporated in a distal endoscope part. Japanese Utility Model Registration No. 3007137 proposes a structure having light emitting diodes as an illuminating means placed around a camera in a distal part of a tubular examination camera system. In these structures, the light emitting unit is protected with a cover glass or acrylic plate placed on the front surface thereof.

Especially in Japanese Utility Model Registration No. 3007137, the cover glass over the front surfaces of the light emitting diodes also works to render the light emitting diodes watertight.

However, when a watertight structure is realized using a transparent member such as the cover glass described in the prior art, the cover glass must have a thickness large enough to position the perimeter thereof relative to a metallic member to support itself therein. In the structure having the cover glass, therefore, mechanical members must be made larger to a dimension corresponding to the perimeter used for positioning the cover glass.

As described in Japanese Utility Model Registration No. 3007137, a structure has the light emitting diodes, which serve as an illuminating means, placed on the outer circumference of an imaging unit and a transparent member placed on the front surfaces of the light emitting diodes. This poses a problem in that the outer diameter of the distal part must be made larger to a dimension corresponding to the perimeter of the transparent member.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a distal endoscope part which makes it possible to realize a side viewing endoscope having a plurality of light emitting diodes placed on the outer circumference of an objective optical system without an increase in the outer diameter of the distal part.

Another object of the present invention is to provide a distal endoscope part which makes it possible to realize a watertight structure without the necessities of placing a transparent member over the front surfaces of the light emitting diodes and of increasing the outer diameter of the distal part.

A distal endoscope part in accordance with the present invention has a plurality of light emitting diodes for supplying illumination light placed as an illuminating means on the outer circumference of an objective optical system. The plurality of light emitting diodes is mounted on a substrate and united therewith. A sub-assembly of the plurality of united light emitting diodes is placed on a plane containing the longitudinal axis of an insertion unit of the endoscope. Consequently, although the side viewing endoscope has the plurality of light emitting diodes placed on the outer circumference of the objective optical system, the outer diameter of the distal part thereof is not large in size.

Other features of the present invention and advantages thereof will be fully apparent from the description below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** to FIG. **10** relate to the first embodiment of the present invention;

FIG. **1** shows the configuration of a side viewing endoscope;

FIG. **2** is a longitudinal sectional view showing the structure of a distal endoscope part shown in FIG. **1**;

FIG. **3** is a cross-sectional view of the A—A plane of the distal endoscope part shown in FIG. **2**;

FIG. **4** is a top view of the distal endoscope part shown in FIG. **2**;

FIG. **5** is a longitudinal sectional view showing the B—B plane of the distal endoscope part shown in FIG. **4**;

FIG. **6** is a cross-sectional view showing the C—C plane of the distal endoscope part shown in FIG. **2** and FIG. **5**;

FIG. **7** is a first explanatory diagram for explaining a first variant of the distal endoscope part shown in FIG. **1**;

FIG. **8** is a second explanatory diagram for explaining the first variant of the distal endoscope part shown in FIG. **1**;

FIG. **9** is a first explanatory diagram for explaining a second variant of the distal endoscope part shown in FIG. **1**;

FIG. **10** is a second explanatory diagram for explaining the second variant of the distal endoscope part shown in FIG. **1**;

FIG. **11** to FIG. **21** relate to the second embodiment of the present invention;

FIG. **11** shows the configuration of a side viewing endoscope;

FIG. **12** is a longitudinal sectional view showing the structure of the distal endoscope part shown in FIG. **11**;

FIG. **13** is a cross-sectional view showing the A—A plane of the distal endoscope part shown in FIG. **12**;

FIG. **14** is a top view of the distal endoscope part shown in FIG. **12**;

FIG. **15** is a longitudinal sectional view showing the B—B plane of the distal endoscope part shown in FIG. **14**;

FIG. **16** is a cross-sectional view showing the C—C plane of the distal endoscope part shown in FIG. **12** and FIG. **15**;

FIG. **17** is a cross-sectional view showing the D—D plane of the distal endoscope part shown in FIG. **12** and FIG. **15**;

FIG. **18** is a cross-sectional view showing the E—E plane of the distal endoscope part shown in FIG. **12**;

FIG. **19** is a longitudinal sectional view showing the structure of a control unit included in the distal endoscope part shown in FIG. **11**;

FIG. **20** shows the structure of a variant of the control unit shown in FIG. **19**;

FIG. **21** shows the structure of a light emitting diode included in the distal endoscope part shown in FIG. **14**;

FIG. **22** to FIG. **24** relate to the third embodiment of the present invention;

FIG. **22** is a longitudinal sectional view showing the structure of a distal endoscope part;

FIG. **23** is a cross-sectional view showing the F—F plane of the distal endoscope part shown in FIG. **22**; and

FIG. **24** is a cross-sectional view showing the G—G plane of the distal endoscope part shown in FIG. **22**.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

As shown in FIG. **1**, a side viewing endoscope **1** has an insertion unit **2** to be inserted into an intracorporeal cavity. A distal endoscope part **3** (hereinafter referred to as a distal part) in accordance with the present invention attached to the distal end of the insertion unit **2** includes an imaging means and light emitting diodes serving as an illuminating means. A control unit **4** attached to the proximal end of the insertion unit **2** has a light level adjustment knob **5** used to adjust an amount of light emitted from the light emitting diodes in the distal part **3**.

An optical image of an object illuminated by the light emitting diodes is projected on an imaging unit included in the distal part **3**, and converted into an electric signal. The electric signal is sent to a camera control unit **7** over a camera control cable **6**. Image data represented by the electric signal is processed by the camera control unit **7** that is powered by an AC adapter **8**. An image signal produced by the camera control unit **7** is transferred to a monitor **10** over a monitor cable **9**. An endoscopic image is then displayed.

As shown in FIG. **2** and FIG. **3**, an imaging unit **13** for converting an optical signal into an electric signal is fixed to a body **15** with a holder **14** between them by means of screws **16**. The imaging unit **13** includes of a solid-state imaging device **11** and electronic parts **12**.

An objective sub-assembly **17** for converging an optical image at the solid-state imaging device **11** is placed ahead of the solid-state imaging device **11**. The optical image represents an object located in a direction of side viewing (at a right angle with respect to the longitudinal direction of the insertion unit **2**).

A signal cable **18** over which a signal is transferred from the camera control unit **7** to the imaging unit **13**, and power cables **20** over which power is supplied to the light emitting diodes **19** serving as an illuminating means are passed through the insertion unit **2**.

As shown in FIG. **4** to FIG. **6**, the light emitting diodes **19** serving as an illuminating means for irradiating illumination light in the direction of side viewing (at a right angle with respect to the longitudinal direction of the insertion unit **2**) are soldered to a substrate **21**. The power cables **20** are also soldered to the substrate **21**. The substrate **21** having the light emitting diodes and power cables united therewith is fixed to a body **22** by means of screws **23**.

The substrate **21** having the plurality of light emitting diodes **19** united therewith lies on a plane containing the longitudinal axis **25** of the insertion unit.

Likewise, part of a first objective surface **30** lies on the plane containing the longitudinal axis **25** of the insertion unit of the endoscope. As long as the outer diameter of the endoscope remains unchanged, the plane containing the longitudinal axis **25** of the insertion unit provides the largest area for the light emitting diodes. If the light emitting diode sub-assembly **19** is placed on this plane, the outer diameter of the distal part **3** can be made as small as possible.

The light emitting diodes **19** are fixed to the body **22** together with the substrate **21**. Thereafter, a substantially transparent filler **24** is injected to fully cover the surroundings of the light emitting diodes **19** and the light emitting surfaces thereof. Even the tops of the light emitting diodes **19** are covered with the filler **24**, whereby the light emitting diodes **19** are not only protected to-be from the outside environment but also left watertight.

The light emitting diodes **19** on the substrate **21** may be, as shown in FIG. **7** and FIG. **8**, mounted in pairs. In this case, the sub-assembly of the light emitting diodes mounted on the substrate **21** is attached to a distal mechanical member. Paired light emitting diodes **19** can therefore be located mutually as closely as possible. Consequently, the width **33** of the substrate can be decreased and the outer diameter of the distal part can be minimized.

Moreover, as shown in FIG. **9** and FIG. **10**, a casing for each light emitting diode **19** may be shaped like a sector in order to improve the density of mounted components and the efficiency in emitting light.

As mentioned above, according to the present embodiment, the substrate **21** having the plurality of light emitting diodes **19** united therewith is placed on the plane containing the longitudinal axis **25** of the insertion unit. Part of the first objective surface **30** is also placed on the plane containing the longitudinal axis **25** of the insertion unit. As long as the outer diameter of the endoscope remains unchanged, the plane containing the longitudinal axis **25** of the insertion unit can provide the largest area for the light emitting diodes. For this reason, the outer diameter of the distal part **3** can be minimized.

In other words, the light emitting diode sub-assembly made by mounting the plurality of light emitting diodes on the substrate is placed on the plane containing the longitudinal axis **25** of the insertion unit. Therefore, the density of mounted components can be improved and the outer diameter of the distal endoscope part can be minimized.

Moreover, the plurality of light emitting diodes can be assembled into the endoscope at the same time. This leads to easy assembling.

Second Embodiment

As shown in FIG. **11**, a side viewing endoscope **101** has an insertion unit **102** that is inserted into an intracorporeal cavity. A distal endoscope part **103** (hereinafter referred to as a distal part) in accordance with the present embodiment attached to the distal end of the insertion unit **102** has an imaging means and light emitting diodes serving as an illuminating means. A control unit **104** attached to the proximal end of the insertion unit **102** has a light level adjustment knob **105** used to adjust an amount of light emitted from the light emitting diodes in the distal part **103**.

An optical image of an object illuminated by the light emitting diodes is projected on an imaging unit in the distal part **103**, and converted into an electric signal. The electric signal is sent to a camera control unit **107** over a camera control cable **106**. Image data represented by the electric

signal is processed by the camera control unit **107** that is powered by an AC adapter **108**. An image signal produced by the camera control unit **107** is transferred to a monitor **110** over a monitor cable **109**. Consequently, an endoscopic image is displayed.

As shown in FIG. **12** and FIG. **13**, an imaging unit **113** for converting an optical signal to an electric signal is fixed to a body **115** in the distal part **103** with a holder **114** between them by means of screws C **116**. The imaging unit **113** includes a solid-state imaging device **111** and electronic parts **112**.

Moreover, an objective sub-assembly **117** for converging an optical image at the solid-state imaging device **111** is located ahead of the solid-state imaging device **111**. The optical image represents an object located in a direction of side viewing (at a right angle with respect to the longitudinal direction of the insertion unit **2**).

A signal cable **118** over which a signal is transferred from the camera control unit **107** to the imaging unit **113**, and power cables **120** over which power is supplied to the light emitting diodes **119** are passed through the insertion unit **102**. The light emitting diodes **119** serve as an illuminating means and will be described later.

As shown in FIG. **14** and FIG. **15**, the light emitting diodes **119** serving as an illuminating means for irradiating illumination light in the direction of side viewing (at a right angle with respect to the longitudinal direction of the insertion unit **102**) are soldered to a substrate **121**. The power cables **120** are also soldered to the substrate **121**. The substrate **121** having the light emitting diodes and power cables united therewith is fixed to a body **122** by means of screws **123**.

The light emitting diodes **119** are fixed to the body **122** together with the substrate **121**. Thereafter, a substantially transparent filler **124** is injected to fully cover the surroundings of the light emitting diodes **119** including the light emitting surfaces thereof. Even the tops of the light emitting diodes **119** are covered with the filler **124**, whereby the light emitting diodes **119** are not only protected to be from the outside environment but also left watertight.

As shown in FIG. **16** and FIG. **17**, the body **115** and body **122** are secured by a screw **125**. Part of a lens frame **127** mounted on the outer circumference of an objective **126** located behind a prism and included in the objective sub-assembly **117** is notched. This is because the dimension between the objective **126** and the body **115** is not large enough to accomodate the thickness of the lens frame **127** around the entire periphery of the objective **126**.

Referring back to FIG. **12**, a cover **128** screwed to the body **115** is fixed to the outer circumference of the imaging unit **113**. A cover **129** is screwed to the cover **128**. The outer circumference of the imaging unit **113** is thus covered by cover **128** and cover **129**. This is intended to reinforce the fixation of the imaging unit **113** to the body **115** after the imaging unit is screwed firmly to the body **115**. An adhesive **130** is therefore injected into a space created by the cover **128**, body **115**, and imaging unit **113**. Since two covers are used in combination, a desired position can be looked at accurately during use of the endoscope. The adhesive **130** can be injected easily.

Moreover, as shown in FIG. **18**, the signal cable **118** and power cables **120** are sandwiched between the cover **129** and a fixture **131**. The tensile strengths in the axial direction of the cables are thus improved. The fixture **131** is fixed to the cover B **129** by screws **132**.

FIG. **19** shows the system control unit **104** shown in FIG. **11**. The light level adjustment knob **105** is located on a back end panel **133** of the control unit **104**. The light level adjustment knob **105** is structured not to jut out beyond the outer circumference **134** of the control unit **104**. Even if a user inadvertently places the endoscope on its side, the switches including the light level adjustment knob **105** will not be affected.

Alternatively, the light level adjustment knob **105** may be, as shown in FIG. **20**, located on the circumference of the control unit **104**. In this case, the light level adjustment knob **105** also will not jut out beyond the outer circumference **134**.

FIG. **21** shows the outline of a light emitting diode **119** employed in the second embodiment. The light emitting diode **119** is made by putting a chip (light emitting device) **161** in a central recess of a ceramic casing **160** and covering the chip portion with a silicon resin **162**.

As mentioned above, in this embodiment, the light emitting diodes **119** are fixed to the body **122** together with the substrate **121**. Thereafter, the substantially transparent filler **124** is injected to fully cover the surroundings of the light emitting diodes **119** including the light emitting surfaces thereof. Since the tops of the light emitting diodes **119** are covered with the filler **124**, it is unnecessary to place a transparent member in front of the light emitting diodes **119** and to increase the outer diameter of the distal part. Moreover, the light emitting diodes **119** can be not only protected to be blocked from the exterior but also to be watertight.

The surroundings of the light emitting diodes and the front light emitting surfaces thereof are covered with the filler in order to realize a watertight structure. This makes it unnecessary to ensure a thickness large enough to support a transparent member used to attain a watertight state as necessary prior art. The outer diameter of the distal part can therefore be made smaller. Moreover, the employment of the filler requires a smaller number of members than the employment of the transparent member such as a glass. Also, the price of the distal part can be lowered.

Third Embodiment

The third embodiment is substantially identical to the second embodiment. Therefore, only the difference will be described below. The same reference numerals will be assigned to identical components.

As shown in FIG. **22** to FIG. **24**, a distal endoscope part **103***a* in accordance with the present embodiment is a distal part for a direct viewing endoscope. An insertion unit including the distal endoscope part **103***a* includes an optical adapter **140** and an endoscope body **141**. The optical adapter **140** is mounted on the outer circumference of the endoscope body **141** and secured to a setscrew **142**, which can rotate only in a circumferential direction, by means of attaching screws **143**.

A plurality of light emitting diodes **119** is placed around circumference of an objective **144** in the optical adapter **140** with the objective **144** as a center (see FIG. **23**). The light emitting diodes **119** are mounted on substrates **145** together with contact pins **146**. The substrates **145** are stowed in an adapter body **147** with the light emitting diodes and contact pins united therewith. Thereafter, a substantially transparent filler **148** is injected to fully cover the light emitting diodes **119** including even the tops thereof. The light emitting diodes **119** are thus rendered watertight.

Power is supplied from the endoscope body **141** to the light emitting diodes **119** in the optical adapter **140** over power cables **120**. Specifically, power is delivered to the contact pins **146** in the optical adapter **140** through contact receptacles **149** provides over the power cables **120**. The power is then supplied to the light emitting diodes **119** via

the substrates **145**. A power supply member shall be composed of the contact receptacles **149** and contact pins **146**. The power supply member is isolated from the metallic member of the body **150** by insulators **151**, insulators **152**, and insulating tubes **153**, and secured by screws **154** (see FIG. **24**).

Even in this embodiment, the filler **148** is injected to fully cover the light emitting diodes **119** including the tops thereof. The light emitting diodes **119** are thus rendered watertight. The same advantage as that provided by the second embodiment can therefore be provided.

As described and illustrated in the present specification, the distal endoscope part **3** is formed a reduced diameter section of an otherwise substantially circular cross-section probe which is associated with the endoscope **1**. The substrate holding the light-emitting diodes and sub-assembly thereof is located on the plane or portion of the reduced diameter free end of the endoscope part **3**.

In the present invention, it is apparent that a wide range of different embodiments can be constructed based on the present invention without a departure from the spirit and scope of the invention. This invention will be limited by the appended claims but not restricted by any specific embodiments described herein.

What is claimed is:

1. A distal endoscope part at the distal end of an insertion unit of an endoscope, comprising:

an objective optical system; and

a plurality of light emitting diodes for supplying illumination light which is placed around an outer circumference of said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly, said substrate is substantially planar and lies on a plane containing the longitudinal axis of said insertion unit of said endoscope.

2. A distal endoscope part according to claim **1**, wherein said sub-assembly is located at a plane of or on a reduced diameter section of the distal endoscope part.

3. A distal endoscope part at the distal end of an insertion unit of an endoscope, comprising:

an objective optical system; and

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope; and

wherein said plurality of light emitting diodes are surrounded with a filler.

4. A distal endoscope part at the distal end of an insertion unit of an endoscope, comprising:

an objective optical system;

an imaging element on which an optical image is projected via said objective optical system; and

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope; and

wherein said plurality of light emitting diodes are surrounded with a filler.

5. An endoscope having an insertion unit that is inserted into a lumen, said insertion unit having a distal part comprising:

an objective optical system on which an optical image falls; and

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope; and

wherein said plurality of light emitting diodes are surrounded with a filler.

6. An endoscope having an insertion unit that is inserted into a lumen, said insertion unit having a distal part comprising:

an objective optical system on which an optical image falls;

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope;

a light level adjusting element used to adjust an amount of light emitted from said plurality of light emitting diodes and located at the proximal end of said insertion unit; and

wherein said plurality of light emitting diodes are surrounded with a filler.

7. An endoscope having an insertion unit that is inserted into a lumen, said insertion unit having a distal part comprising;

an objective optical system on which an optical image falls;

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system; and

an imaging element on which said optical image is projected via said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope, and

wherein said plurality of light emitting diodes are surrounded with a filler.

8. An endoscope having an insertion unit that is inserted into a lumen, said insertion unit having a distal part comprising;

an objective optical system on which an optical image falls;

a plurality of light emitting diodes for supplying illumination light which is placed around the outer circumference of said objective optical system; and

an imaging element on which said optical image is projected via said objective optical system,

wherein said plurality of light emitting diodes is mounted on a substrate and united therewith to form a sub-assembly which is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope, and

a light level adjusting element used to adjust an amount of light emitted from said plurality of light emitting diodes and located at the proximal end of said insertion unit, and

wherein said plurality of light emitting diodes are surrounded with a filler.

9. An endoscope having an insertion unit that is inserted into a lumen, said insertion unit having a distal part comprising;

an objective optical system on which an optical image falls and having an optical axis; and

light emitting diodes for supplying illumination light which are placed as an illuminating means around an outer circumference of said objective optical system;

wherein said light emitting diodes are mounted on a substrate and united therewith, and said substrate is located substantially in a plane and said plane extends substantially perpendicular to the optical axis of said objective optical system; and

wherein said substrate is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope.

10. An endoscope according to claim **9**, wherein the distal end member of said objective optical system is placed on a plane containing the longitudinal axis of said insertion unit of said endoscope.

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